What is claimed is:

1. A cardiac pacemaker, comprising:

first and second pacing channels, each such channel comprising an electrode for disposing near a chamber of the heart, a pulse generator for outputting pacing pulses, and a channel interface for adjusting the pacing pulse energy;

a controller for controlling the operation of the pulse generators in response to sensed events and lapsed time intervals and in accordance with a programmed pacing mode;

an evoked response sensing channel comprising an electrode and a sense amplifier for sensing an evoked response generated after a pacing pulse; and,

wherein the controller is programmed to:

deliver first and second pacing pulses from the first and second pacing channels, respectively, to one or both of the paired atria or to one or both of the paired ventricles during a cardiac cycle; and,

record a test electrogram from the evoked response sensing channel and compare the test electrogram with a template electrogram representing capture of the heart by at least one pacing pulse in order to determine if capture has been achieved by one or both of the delivered pacing pulses.

2. The pacemaker of claim 1 wherein the first and second pacing channels are right and left ventricular pacing channels.

3. The pacemaker of claim 1 wherein the controller is programmed to compare the test and template electrograms by performing a time-domain cross-correlation.

4. The pacemaker of claim 1 wherein the controller is programmed to compare the test electrogram with a template electrogram representing capture of the heart by both of the first and second pacing pulses, with a template electrogram representing capture by a pacing pulse delivered only from the first pacing channel, and with a template electrogram representing capture by a pacing pulse delivered only from the second pacing channel in order to determine which of the delivered pacing pulses have achieved capture.

5. The pacemaker of claim 1 wherein the controller is further programmed to vary the pulse energy of the pacing pulses in order to determine a capture threshold for a pacing channel.

6. The pacemaker of claim 5 wherein the controller is further programmed to lower the pacing pulse energy of a pacing channel until capture is no longer achieved by that channel in order to determine the capture threshold.

7. The pacemaker of claim 6 wherein the controller is programmed to determine a capture threshold for each of the first and second pacing channels by lowering the pacing energy of each pacing channel separately until the test electrogram no longer matches a template electrogram representing capture by both of the first and second pacing pulses.

8. The pacemaker of claim 6 wherein the controller is programmed to determine a capture threshold of the first and second pacing channels by:

lowering the pacing energy of the first pacing channel until the test electrogram matches a template electrogram representing capture by the second pacing pulse but not by the first pacing pulse; and,

lowering the pacing energy of the second pacing channel until the test electrogram matches a template electrogram representing capture by the first pacing pulse but not by the second pacing pulse.

9. The pacemaker of claim 6 wherein the controller is programmed to:

lower the pacing energy of the first and second pacing channels simultaneously until the test electrogram no longer matches a template electrogram representing capture by both of the first and second pacing pulses;

compare the test electrogram to a template electrogram representing capture by a pacing pulse delivered only from the first pacing channel and to a template electrogram representing capture by a pacing pulse delivered only from the second pacing channel to determine the capture threshold of the pacing channel or channels that failed to capture in the previous step; and,

determining the capture threshold of a pacing channel that succeeded in capturing in the previous step by lowering the pacing energy of that channel until the test electrogram no longer matches a template electrogram representing capture by a pacing pulse delivered individually from that channel.

10. The pacemaker of claim 5 wherein the controller is further programmed to adjust the pacing pulse energy of a pacing channel in accordance with the results of the capture threshold determination.

11. The pacemaker of claim 1 wherein the controller is programmed to determine if capture has been achieved during each cardiac cycle on a beat-to-beat basis.

12. The pacemaker of claim 11 wherein the controller is further programmed to deliver a safety pace if capture has not been achieved during a cardiac cycle.

13. The pacemaker of claim 1 wherein the cross-correlation is performed with a matched filter having filter coefficients that represent the template electrogram.

14. The pacemaker of claim 1 further comprising one or more additional pacing channels and wherein both the atria and the ventricles are paced.

15. A system for determining capture thresholds for a multi-site cardiac pacemaker, comprising:

a pacemaker having: (a) first and second pacing channels with each such channel comprising an electrode for disposing near a chamber of the heart, a pulse generator for outputting pacing pulses, and a channel interface for adjusting the pacing pulse energy, (b) a controller for controlling the operation of the pulse generators in accordance with a programmed pacing mode such that first and second pacing pulses are delivered from the first and second pacing channels, respectively, to one or both of the paired atria or to one or both of the paired ventricles during a cardiac cycle, and (c) a telemetry interface for communicating with an external programmer;

an external programmer having a controller for processing data received from the pacemaker, wherein the controller is programmed to record a test depolarization waveform produced by the pacing pulses and compare the test waveform with a template of a depolarization waveform representing capture of the heart by at least one pacing pulse in order to determine if capture has been achieved by one or more of the delivered pacing pulses.

16. The system of claim 15 further comprising an evoked response sensing channel in the pacemaker comprising an electrode and a sense amplifier for sensing an evoked response generated after a pacing pulse and wherein the test waveform is an electrogram from the evoked response sensing channel and transmitted to the external programmer.

17. The system of claim 15 wherein the test waveform is a surface electrocardiogram.

18. The system of claim 15 wherein the controller of the external programmer is programmed to compare the test and template waveforms by performing a time-domain cross-correlation.

19. The system of claim 15 wherein the controller is programmed to compare the test waveform with template waveforms representing capture of the heart by each of the pacing pulses delivered individually by the pacing channels and with a template waveform representing capture of the heart by each of the pacing pulses delivered collectively by the pacing channels in order to determine which of the delivered pacing pulses have achieved capture.

20. The system of claim 15 wherein the external programmer controller is further programmed to vary the pulse energy of the pacing pulses in order to determine a capture threshold for a pacing channel.

21. The system of claim 20 wherein the external programmer controller is further programmed to lower the pacing pulse energy of a pacing channel until capture is no longer achieved by that channel in order to determine the capture threshold.

22. The system of claim 21 wherein the external programmer controller is programmed to determine a capture threshold for each of the first and second pacing channels by lowering the pacing energy of each pacing channel separately until the test waveform no longer matches a template waveform representing capture by both of the first and second pacing pulses.

23. The system of claim 21 wherein the external programmer controller is programmed to determine a capture threshold of the first and second pacing channels by:

lowering the pacing energy of the first pacing channel until the test waveform matches a template waveform representing capture by the second pacing pulse but not by the first pacing pulse; and,

lowering the pacing energy of the second pacing channel until the test waveform matches a template waveform representing capture by the first pacing pulse but not by the second pacing pulse.

24. The system of claim 21 wherein the external programmer controller is programmed to:

lower the pacing energy of the first and second pacing channels simultaneously until the test waveform no longer matches a template waveform representing capture by both of the first and second pacing pulses;

compare the test waveform to a template waveform representing capture by a pacing pulse delivered only from the first pacing channel and to a template waveform representing capture by a pacing pulse delivered only from the second pacing channel to determine the capture threshold of the pacing channel or channels that failed to capture in the previous step; and,

determine the capture threshold of a pacing channel that succeeded in capturing in the previous step by lowering the pacing energy of that channel until the test waveform no longer matches a template waveform representing capture by a pacing pulse delivered individually from that channel.

25. The system of claim 20 wherein the external programmer controller is further programmed to adjust the pacing pulse energy of a pacing channel in accordance with the results of the capture threshold determination.

26. A method for determining capture thresholds for a multi-site cardiac pacemaker, comprising:

delivering first and second pacing pulses through first and second pacing channels, respectively, to either the atria or the ventricles during a cardiac cycle in accordance with a programmed pacing mode; and,

recording an evoked response depolarization waveform produced by the pacing pulses and comparing the test waveform with a template depolarization waveform representing capture of the heart by at least one pacing pulse in order to determine if capture has been achieved by the delivered pacing pulses.

27. The method of claim 26 wherein the comparison between the test and template waveforms is performed with a time-domain cross-correlation.

28. The method of claim 26 wherein the test waveform is a surface electrocardiogram.

29. The method of claim 26 further comprising comparing the test waveform with template waveforms representing capture of the heart by each of the pacing pulses delivered individually by the pacing channels and with a template waveform representing capture of the heart by each of the pacing pulses delivered collectively by the pacing channels in order to determine which of the delivered pacing pulses have achieved capture.

30. The method of claim 26 further comprising varying the pulse energy of the pacing pulses in order to determine a capture threshold for a pacing channel.

31. The method of claim 30 further comprising lowering the pacing pulse energy of a pacing channel until capture is no longer achieved by that channel in order to determine the capture threshold.

32. The method of claim 31 further comprising determining a capture threshold for each of the first and second pacing channels by lowering the pacing energy of each pacing channel separately until the test waveform no longer matches a template waveform representing capture by both of the first and second pacing pulses.

33. The method of claim 31 further comprising determining a capture threshold of the first and second pacing channels by:

lowering the pacing energy of the first pacing channel until the test waveform matches a template waveform representing capture by the second pacing pulse but not by the first pacing pulse; and,

lowering the pacing energy of the second pacing channel until the test waveform matches a template waveform representing capture by the first pacing pulse but not by the second pacing pulse.

34. The method of claim 31 further comprising:

lowering the pacing energy of the first and second pacing channels simultaneously until the test waveform no longer matches a template waveform representing capture by both of the first and second pacing pulses;

comparing the test waveform to a template waveform representing capture by a pacing pulse delivered only from the first pacing channel and to a template waveform representing capture by a pacing pulse delivered only from the second pacing channel to determine the capture threshold of the pacing channel or channels that failed to capture in the previous step; and,

determining the capture threshold of a pacing channel that succeeded in capturing in the previous step by lowering the pacing energy of that channel until the test waveform no longer matches a template waveform representing capture by a pacing pulse delivered individually from that channel.

35. The method of claim 31 further comprising adjusting the pacing pulse energy of a pacing channel in accordance with the results of the capture threshold determination.

36. A cardiac pacemaker, comprising:

a pacing channel comprising an electrode for disposing near a chamber of the heart, a pulse generator for outputting pacing pulses, and a channel interface for adjusting the pacing pulse energy;

a controller for controlling the operation of the pulse generator in response to sensed events and lapsed time intervals in order to deliver pacing pulses in accordance with a programmed pacing mode;

an evoked response sensing channel comprising an electrode and a sense amplifier for sensing an evoked response generated after a pacing pulse; and,

wherein the controller is programmed to record a test electrogram from the evoked response sensing channel during delivery of a pacing pulse and compare the test electrogram with a template electrogram representing capture of the heart by a pacing pulse in order to determine if capture has been achieved by the delivered pacing pulse.